



Effects of Microgravity on Intracranial Pressure

Problem Statement

- Visual changes and symptoms experienced by long duration ISS crewmembers are consistent with increased intracranial pressure (ICP), however there have been no direct measures of human ICP in microgravity
- Parabolic flights will provide ICP data and associated physiological parameters in microgravity while simultaneously validating technology and methods
- NASA research, Medical Operations, and terrestrial medicine are potential users

Technology Development Team

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- Wyle, Science, Technology & Engineering Group
- National Space Biomedical Research Institute (NSBRI)
- NASA Human Research Program – Visual Impairment/Intracranial Pressure

Proposed Flight Experiment

Experiment Readiness:

Summer 2014

Test Vehicles:

Parabolic aircraft

Test Environment:

Parabolic flight (microgravity) is requested to test the hypotheses. Components of this experiment have previously flown in microgravity (e.g. ultrasound during parabolic flight and invasive catheters on Shuttle mission SLS-1).

Test Apparatus Description:

Test subjects will be instrumented for direct (invasive) measurement of ICP (via Ommaya reservoir) and central venous pressure (CVP) (via catheter to the right atrium). Other measures include eye and vascular ultrasound, ECG, blood pressure, transcranial Doppler (TCD), and end tidal CO₂. At least one method of non-invasive ICP monitoring is also planned. Data will be collected during rest, rest with 0.7% CO₂ inhalation, and leg exercise with 0.7% CO₂ inhalation.



Technology Maturation

- In order to elevate the TRL level of these methods and demonstrate the related physiology, these experiments must be conducted in a relevant environment
- The current payload is at TRL6. These flights will validate a variety of equipment and methods in microgravity. Validation of a non-invasive device would quickly advance all methods to TRL 7 and prepare them for spaceflight.
- Knowledge gained through these experiments will be directly applicable to ongoing ground- and space-based investigations.

Objective of Proposed Experiment

- Perform a comprehensive assessment of ICP and cerebrovascular hemodynamics during gravitational transients, including the effects of exercise and CO inhalation
- Validate invasive and non-invasive ICP monitoring technology and methods in altered gravity